applying a resist material on the fabric substrate in a pattern of streets dividing the surface of the substrate into islands,

coating the fabric substrate with epoxy resin, and

removing the resist material.

REMARKS:

The above amendments to the specification are merely form. No new matter is added.

Applicant herein summarizes the office correspondence dated 12/03/01 and responds as follows:

The Office acknowledged the Applicant's prior submissions, amendments and accepted its terminal disclaimer with respect to the '623 patent.

re Para. 17 Double Patenting rejection:

The Office asserts a double patenting rejection of claims 1- 8 with respect to US5565264, with comments. Applicant herewith provides a terminal disclaimer, thus resolving this rejection.

re Para 20 - 35USC102 rejection:

The Office rejects claim 1 under 35 U.S.C. 102(b) as anticipated by Dunbar's '628, citing in part to Dunbar's col. 7, lines 56-60, where Dunbar makes reference to the option of also employing a second kind of filament different from the entangled filament.

Applicant respectfully asserts that in this section while Dunbar does report that his fabric might include a filament of another type, it can only be interpreted to mean that the specifics of any second kind of filament are irrelevant to the ballistic performance of the relatively open weave fabric so long as it includes his entangled yarn of high strength filaments in one of either the warp or fill direction. In oth r words, all he is saying is that the fabric need not be 100 percent

comprised of his entangled filament yarns. He is willing to depend solely on using the entangled filaments in one direction or the other as opposed to not using any entangled filaments in either direction, to achieve the benefit of his invention.

This is noteworthy in the context of this prosecution because it displays as a minimum, first, a lack of appreciation by Dunbar for the difference in fabric performance attributable to whether a particular yarn is used as a warp or fill material, and, second, his lack of appreciation for the difference a preferred matchup of warp and fill yarns of optimal characteristics for use in their respective roles can make in the total fabric performance, all of which was amply discussed in this Applicant's disclosure.

Furthermore, and perhaps foremost, the Dunbar claim to entangled filament yarns is presented in the context of fabrics constructed with low yarns per inch of warp and fill yarns as in normal or relatively open weaves so that the yarns are normally disposed in a flattened or ribbon like manner throughout the fabric, as is illustrated in his figures. He recites examples of weaves ranging from 31 x 31 to 56 x 56 in warp and fill yarns per inch, and makes not a single reference to higher density weaves. One can only conclude that he simply did not experience or anticipate the phenomena seen by this Applicant.

In particular, Dunbar's disclosure is distinctly void of consideration of the high density weave fabrics discussed in this Applicant's disclosure, cited examples of which included 90 x 88 and 130 x 86 weaves using 200 denier warp and 200 denier fill yarns, and 100 x 68, 110 x 67, and 130 x 65 weaves using 200 denier warp and 400 denier fill yarns. Applicant, at page 5, lines 17+ for example, expressly contrasts weaves at 70 x 70 yarns per inch with the higher density weaves cited, illustrating the varying path and cross section geometry of the warp yarn in particular, as it undulates over and under the higher denier fill yarns.

More subtle but also significant, absolutely no distinction or benefit is recognized by Dunbar in any of his several examples for using other than a square weave in yarns per inch and in using yarns of the same weight or denier for both warp and fill. The only example given that is other than square is his Example 6, which uses a 28 x 56, which actually reverses what this

Applicant has demonstrated is the preferred warp to fill yarn per inch ratio for high density weaves. And in all cases, Dunbar uses warp and fill yarns of equal denier. Clearly, there is absolutely no anticipation of the teachings provided by this Applicant, or of its claim 1 as amended.

In part, the quantification of total fiber content in each of the warp and fill directions as the yarn count-per-inch times the yarn denier, combined with the recognition of the working requirements of the warp yarn in the high density weaving process, as well as significant research and experimentation, led the Applicant to the invention as claimed in claim 1. As has been amply demonstrated to the Office, the Applicant is skilled in the art, holds several related patents, and is very familiar with the industry.

Of course, "Claims directed to an apparatus must be distinguished from the prior art in terms of structure...."; In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Also, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053, (Fed. Cir. 1987). Finally, for a 35 U.S.C. 102 rejection to apply, "The identical invention must be shown in as complete detail as is contained in the ... claim", Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, (Fed. Cir. 1989). Applicant has herein amended claim 1 to include the limitation of its prior claim 2, conforming this base claim to a preferred embodiment describing the fill yarn denier as greater than the warp yarn denier, while providing a specific limitation in application to densely woven fabrics, which were amply described in the specification. This specificity in the claim, based on well founded and well presented discovery, is clearly neither expressly nor inherently described, or shown in as complete detail in Dunbar.

Based on the applicable legal standard, claim 1 as amended should easily prevail as patentable under 35 USC 102(b) over an irrelevant Dunbar generality which does not recognize, consider, describe or anticipate the special characteristics and requirements of densely woven fabrics and the special relationship between the warp and fill yarns. Independent claim 6 is the same as claim 1 but includes the further limitation of having warp crimp greater than fill crimp,

which is clearly supported in the specification, and should therefore be likewise allowable. Dependent claims 2-4 and 7-8, and new dependent claims 10 - 15 are dependent on one or the other of these base claims and should therefore be allowable as well.

Applicant believes the amendment and these remarks to cure the 102 rejection of claim 1 and respectfully requests speedy reconsideration thereof.

re Para. 20 - 35USC103(a) rejection:

The Office also rejects claims 1-4 and 6-8 under 35 U.S.C. 103(a) as being unpatentable over the same reference, citing back to the same Dunbar language at col. 7, lines 56-60. In response, Applicant respectfully invokes its prior remarks including case law citations and further remarks as follows:

When applying 35 U.S.C. 103, the following tenets are applied: (a) the claimed invention must be considered as a whole; (b) the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (c) the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and (d) reasonable expectation of success is the standard with which obviousness is determined. Hodosh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5 (Fed. Cir. 1986).

It this case, the Dunbar disclosure about normal or open weave flat fabrics cannot be fairly said to suggest the desirability of making a very high density weave fabric where the shape of the warp yarn cross section is so much different. As is illustrated in this Applicant's Figs. 2A, 2B and 2C, the yarn bundle geometries in a densely woven fabric are necessarily different than is contemplated by the Dunbar patent. Even the Applicant's point of departure of his Figs. 1A and 1B, at a 70 x 70 yarn per inch weave, are notably denser than the normal or open weave fabrics and flat cross section warp and fill yarns of Dunbar.

The Office alleges Dunbar's col. 7, lines 56-60 to imply there is a difference in the warp and the fill yarns. The text there reads, "...what is important .... is that it includes an entangled

yarn of high strength filaments *in either* the warp or fill direction." (italics added). The only interpretation that can be fairly gleaned from this language is that there is *no difference* in the warp and fill yarns, from Dunbar's perspective, as to where to place his entangled yarn.

The specification includes references to several preferred embodiments on one basis or another, usually with a rational to support the preference. However, at col. 9, lines 62-65, where he does once suggest a preference for some twist in the warp and not in the fill, in all of his col. 9 discussion about twist he provides no insight or reason as to this preference. Indeed, he says at col. 9, line 60, that "*the fill and/or the warp yarns* can be twisted and entangled". One skilled in the art would more readily conclude it is simply more convenient to the manufacturing process to have it in the warp rather than the fill.

In light of the overall specification, its focus on entangled filaments and lack of specificity and justification as to where they should be placed in the weave, it is an overextension of logic and the result of impermissible hindsight to attribute the minor nuance of a twist preference to Dunbar as "proportional balancing", and yet a further overextension to say that the sole mention of where to place the twist obviates Applicant's claims 1 - 4 and 6 - 8, where a balancing of the denier is included in the claims and soundly supported in the specification.

Independent claim 1 has been amended to be applicable to densely woven fabrics and herein further amended to specify the fill yarn preference for greater denier than the warp yarn, as was discussed above, further distinguishing it from the prior art. Applicant believes the amendments and remarks to place claim 1 as amended in condition for allowance, and requests speedy reconsideration thereof.

Independent claim 6 is the same as claim 1 but includes the further limitation of having warp crimp greater than fill crimp, which is clearly supported in the specification, and should therefore be allowable. Dependent claims 2-4 and 7-8, and new dependent claims 10 - 15 are dependent on these base claims and should therefore be allowable as well.

re Para 21 - 35USC103(a) rejection:

The Office rejects claims 1 and 5 under 35 U.S.C. 103(a) as being unpatentable over Dunbar's '628 in view of Harpell's '012. Applicant invokes its remarks from the 102/103 rejections above, including case law citations and remarks further as follows:

Independent claim 1 as amended, has been fully discussed with regard to Dunbar. Dependent claim 5 is cancelled and replaced in substance by new claims 14 and 15 dependent on claims 1 and 6 respectively, which provides the limitation in substantially the same language as allowed in claim 25 of parent application 297,593, now issued as US5565264. The new claims introduce the further limitation as a repeatedly interrupted coating of epoxy resin applied to the substrate, as is fully supported in the specification and are presumed to be subject to this rejection for the purpose of these remarks.

Additional new independent claim 16, incorporating the limitations of claim 1 and cast as a methods claim, delineates the steps for producing the Applicant's epoxy resin islands on the fabric substrate, and is also presumed to be subject to this rejection for the purpose of these remarks.

Applicant offers the following as a full and fair reading of Harpell, objectively summarized without impermissible hindsight as required by Hodosh. Harpell discloses flexible fibrous layers, which are analogous to this Applicant's fabric substrate. He discloses a multi-layer configuration where the fiber direction orientation as between adjacent flexible fiber layers is offset at a desirable angle to improve resistance to penetration.

He then introduces at col. 2, line 48, an additional layer, a rigid layer comprising *a plurality of rigid bodies* , (italics added) this layer arranged with the flexible fiber layers to be a more penetration resistant article. His Figure 4 is briefly described at col. 3, line 42-45 as a cross section of "body armor... which includes a plurality of rigid ballistic resistant elements on outer surfaces of a plurality of fibrous layers." The rigid elements are clearly visible and later described

as ref. # 20 "planar bodies." Fig. 5 illustrates a variation, where the "planar bodies" are attached to one side of two separate "fiberous layers".

His Fig. 6 clearly illustrates the "triangular shaped rigid panels laminated and *sewn on* to both sides of a stitched fabric", (italics added) as described at col. 3, lines 51-55. Fig. 7 extends the clear illustration of what can be described as small triangular pieces of armor plate, arranged and stitched to a fabric layer so as to provide additional penetration resistance and some degree of drape capability. Figs. 8 and 9 provide other examples of how the rigid little armor plates might be patterned for attachment to the fabric layers. Fig. 10 illustrates the triangular armor element with holes obviously intended for stitching or lacing the plate to the fabric.

The fibers and fabric layers and ways the layers can be stitched together are described at great length in columns 4 - 12, to line 47, without further reference to the little rigid armor plates.

Finally, at col. 12, line 51, referring to Figs. 3, 4, and 5, the little rigid armor plates are re-introduced as "planar bodies 20" which are "affixed" to the surfaces of one or more fabric layers. At line 65, there is introduced a "ballistic layer 24, which, in the body armor of the figures comprises a plurality of stitched layers 12 having a plurality of planar bodies 20 partially covering both outer surfaces of said plurality of layers 12 forming a pattern of covered areas 28 and uncovered areas 30 on the outer surfaces."

At col. 13, line 36 on, the specification picks up in great detail the planar bodies or armor pieces, their material, shape, placement, and point of attachment, and other details. For example, at col. 14, line 11-13, it is contemplated that the "point of attachment" of the piece be "away from the boundary" for greater flexibility, strongly implying a stitched attachment of the piece to the fabric. Spacing between the armor pieces is contemplated for greater flexibility of the fabric. Encapsulation of the little armor pieces between layers of fabric is contemplated. Examples of means of fastening are listed at col. 15, line 26, include bolts, screws, staples, mechanical interlocks, adhesives, stitching and the like, "or any combination of these." The preferred method is cited as stitching, which might be supplemented with an adhesive. Most notable, at col. 15,

line 34: "Planar bodies 20 are comprised of rigid ballistic material .... The term "rigid" as used in the present specification and claims is intended to mean free standing..."

The specification then goes on to discuss the various possible compositions of the planar bodies, including the use of fiber reinforced resins as well as metals. In all cases, however, it is consist with the very clear mandate that the little armor plates are free standing rigid armor pieces that are then attached to the fabric by the means described.

After reading all of Harpell for what it teaches with regard to reinforcing a fabric for greater resistance to penetration, it can be stated unequivocally that there is every contemplation of using a "planar piece" that is a pre-formed, rigid member requiring a means of attachment suitable to attaching rigid pieces of metal or plastic to a fabric. However, there is no room or suggestion of the desirability or possibility of success or other possible way to interpret this as obviating the applicant's use of a coating of epoxy resin applied to the fabric substrate over a pattern of resist material that results in hardened islands of armor after the resist material is removed. Applicant utterly fails to find a connection here that rises to the level required under case law to support a 35 USC 103(a) rejection of the affected claims as amended.

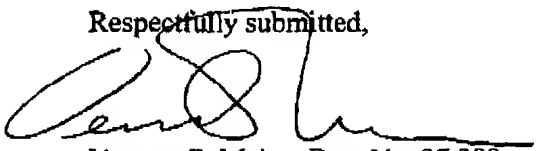
Applicant believes the amendments in particular, and these remarks, to overcome the rejection and respectfully requests it be withdrawn.

In summary, Applicant believes the amendments to the specification and claims, along with these remarks, to place the application in condition for allowance, and respectively requests consideration thereof. In light of the prosecution history, Applicant invites the Examiner to contact its new undersigned agent for discussion and prompt resolution of any remaining issues.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

Applicant believes the above amendments and remarks to be fully responsive to the Office Action, thereby placing this application in condition for allowance. No new matter is added. Applicant requests speedy reconsideration, and further requests that Examiner contact its attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

Paragraph beginning at page 10, line 8, has been amended as follows:

1. Section title beginning at page 2, line 20, has been deleted:

2. Section title has been inserted beginning at page 2, line 4 as follows:

SUMMARY OF THE INVENTION

3. Paragraph beginning at page 2, line 10, has been amended as follows:

-- Still a further object of the invention is to provide a fabric having enhanced resistance to penetration by both blunt and sharp instruments and that is characterized by an acceptable drapability. --

4. Section title has been inserted beginning at page 3, line 18, as follows:

--DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS--

5. Paragraph beginning at page 3, line 30, has been amended as follows:

--"Normal" density fabrics typically are 50x50 (i.e., 50 warp yarns to the inch by 50 fill yarns to the inch) [ro] to 70x70, for example, at 200 denier. Such fabrics have little resistance to penetration, even when used in multiple layers. In accordance with the present invention, however, a protective fabric having extremely high penetration resistance is formed by layering a plurality of densely woven fabric sheets of construction ranging from 90x88 to 130x86 at 200x200 denier, and from 100x68 to 130x65 at 200x400 denier. Fabrics at these levels of construction are known as "densely woven", "tightly woven" or "overconstructed", and are known but uncommon. They have

heretofore been used in [said] sail cloth but not, to my knowledge, in protective clothing. For use in the present invention, the fabrics are preferably woven from a high-modulus, multi-filament material such as a standard type 29 Kevlar material. The resultant protective fabrics are characterized by high penetration resistance, good drapability, and relatively low cost per unit of resistance.--

6. Paragraph beginning at page 6, line 6, has been amended as follows:

-- Another indicator of the geometric structure of the fabric of the present invention is the amount of overlap or "cover" between adjacent warp yarns as measured at the fill crossing. Referring to Fig. 2B, the cover may be determined as the sums of each of the widths w of the yarns in a given cross section, divided by the length, "l", of the cross section. Referring now to Fig. 3, the cover of a typical normal fabric (70x70, 200x200) as well as that of several densely woven yarns in accordance with the [preset] present invention is shown. As seen in Fig. 3, the cover 30 of the normal fabric is of the order of approximately 115%, with 100% indicating essentially no overlap, on average. In contrast, the cover of densely woven fabrics in accordance with the present invention is significantly higher. Thus, the cover 32 of a 90x88 (200x200) fabric is of the order of 130%. The cover 36 of a 110x67 (200x400) fabric is seen to be just slightly in excess of the 90x88 fabric, while the cover 34 of a 131-65 (200x400) fabric is even higher, approximately 140%.--

7. Paragraph beginning at page 6, line 18, has been amended as follows:

--Still another measure of the structure [measure of the structure] of the fabric of the present invention is the ratio of its "crimp" in the warp direction verses its crimp in the fill direction. The crimp in a given direction (warp or fill) is defined as the length of a given section of yarn along that direction when woven divided by the length of the same yarn when freed from its woven state in the section. Fig. 4 shows the amount of crimp for different fabrics, namely, a 70x70 (200x200) (indicated as element 40), a 90x88 (200x200) (element 42), a 110x67 (200x400) (element 44), and a 131[-]x65 (200x400)

(element 46) fabric. The crimp along both the warp (e.g., 40) and fill (e.g., 40b) directions for each of these fabrics is given. It is readily seen that the crimp in the normal fabric (element 40) is significantly less than that of the densely woven fabrics used in the present invention. (42, 44, 46). --

8. Paragraph beginning at page 11, line 30, was amended as follows:

-- The tightly woven substrate of the present invention offers penetration resistance both to circular and cutting type penetrators. Based on tests, the substrate of the invention offers the following advantages. 1) The substrate provides resistance to circular penetrators such as ice pics, awls and homemade prison weapons. 2) The substrate provides resistance to cutting edge penetrators including UK test knives, German Othello test daggers and U.S. Russell boning knives. 3) The substrate provides resistance to small diameter penetrators like[s] thorns and sharp sticks. 4) The substrate provides resistance to puncture by small cutting penetrators like hypodermic needles. 5) The substrate provides cut and slash resistance approximately 19 times greater than that offered by ballistic fabrics. 6) The substrate provides reduction of depth of trauma resulting from ballistic type impacts. Used in combination with and placed behind typical ballistic materials, the substrate of the present invention reduces measured backside trauma depth by a factor of 2 to 3 times. This allows for an attractive combination of ballistic performance where NIJ ballistic performance of a level 2a or 3 can be achieved with layer counts similar to current ballistic vest-only systems. The ballistic performance was maintained by substituting 1/3 to1/2 of the ballistic layers with the substrate of the present invention. Dramatic improvements in stab and puncture resistance were achieved. The depth of backside trauma is much improved over the all-ballistic product. 7) The substrate provides reduction of blunt trauma resulting from blows from striking club-like weapons and thrown objects such a sharp stones. As above, the substrate of the present invention provided significant reduction in the depth of the affected zone. The high-bias stiffness of the tightly woven substrate of the present invention prevents the material from forming deep concave indents. The substrate of the invention strongly resists being bent into compound curves having small radii. In order

for a striking blow or a rock to deeply indent the substrate, the fabric must conform to this concave shape. The substrate of the invention, with its very high off-thread line and bias stiffness, lacks the drape and elongation necessary for the deep indenting. The substrate of the invention spreads out the point of contact and distributes the impact forces over a large area of tissue. Based on the use of Roma plastilina as a tissue stimulant, 1-4 layers of the substrate of the invention can reduce the depth of trauma by a factor of 5-10 times. 8) The substrate of the invention provides abrasion resistance for sliding wear situations in industrial protective apparel. Gloves, gauntlets, aprons and chaps all require a combination of cut and abrasion resistance. The substrate of the present invention offers excellent cut and abrasion resistance to suit the industrial protective apparel application.--

In the Claims:

Claim 1 has been amended as follows:

1. (Amended) A protective fabric substrate for protection against puncture, penetration and/or ballistics comprising:

a plurality of warp yarns densely interwoven with a plurality of fill yarns; [wherein a denier of the fill yearn is not equal to a denier of the warp yarn.] wherein the denier of the fill yarn is greater than the denier of the warp yarn.

Claim 3 has been amended as follows:

3. (Amended) The protective fabric substrate as claimed in claim [2] 1 wherein the denier of the fill yarn is at least 1.5 times greater than the denier of the warp yarn.

Claim 2 has been canceled

Claim 5 has been canceled

New claims 10 – 16 have been added